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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/529,633 | 08/26/2005 | Christopher John Howard Wort | 266485US6PCT | 1368 |

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| EXAMINER | |
|---|---|
| MILLER, DANIEL H | |
| ART UNIT | PAPER NUMBER |
| 1794 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 06/01/2009 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/529,633 | WORT ET AL. | |
| | Examiner | Art Unit | |
| | DANIEL MILLER | 1794 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *2/27/2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *39-45 and 47-80* is/are pending in the application.

4a) Of the above claim(s) *57-77* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *39-45,47-56 and 78-80* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 39-45, and 47-56, 78-80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saito (US 6,641,861) in view of Zhu (US 5,849,413).

3. Saito teaches a heat sink formed from a thin diamond film and a substrate (see figures). The thin diamond film operates as a heat spreader ( see column 2), Saito desired a thin layer so that it can match the thermal expansion of adjacent semiconductor devices and prevent peeling off (column 2 thru 3). The layer should be at least 10 micrometers thick to function to dissipate in plane heat but not more than 200 micrometers (see column 4 lines 30-60). The substrate should be much thicker than the thin diamond film with exemplary thicknesses being from 200 to 1000 micrometers (column 4).

4. However Saito is silent as to the a CVD grown layer epitaxially bonded to a substrate.

5. Zhu teaches a diamond film formed via CVD methods (abstract). The CVD film is formed on a substrate having diamond grains deposited on the surface of the substrate

and incorporated into the matrix material (usually Ni) (see figure 2). The diamond particles are partially embedded into the surface of the substrate with diamond grains being exposed to the surface (figure 2). The examiner is considering the partially embedded diamond particles to be a (DL) material having "diamond particles in a matrix" and also having surface with exposed diamond particles as claimed. The diamond films are considered to be hole and free and continuous to the extent to which applicant has defined the terms (see examples). The film is inherently "at least in part" bonded to the particles by epitaxy because the diamond film is formed on the diamond particles in a CVD process substantially similar to applicant's process.

6. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide the substrate and growth and adhesion method of Zhu in order to provide a diamond film with good adhesion and growth on a non diamond substrate (applicant's DL layer) and taking advantage of the excellent heat dissipation qualities of the diamond layer (see column 1 Zhu).

7. Zhu is silent as to the size of the diamond grains or the percentage exposed to the surface.

8. Regarding the percentage exposed, generally, differences in concentration will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

9. It would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize the percentage of exposed surface in contact with diamond grains and in so doing provide greater than 30% or greater than 70% exposed surface epitaxy of the DL/ CVD layer interface by providing optimal diamond nucleation sites in order to grow a high quality well adhered diamond film covering the entire surface of the substrate of Zhu that doesn't peel off and has good adhesion to the substrate (wherein the non diamond substrate of Zhu won't grow diamond). No patentable distinction is seen.

10. Regarding the grain (or crystal) size of the DL layer one of ordinary skill would also have found it obvious to provide a grain size of at least 10 micrometers with a thickness four times greater than the thickness of the CVD layer because such a size would be within the scale of the disclosed thicknesses of the substrate and CVD layers taught by Saito especially wherein thinner CVD layer of 10 or 20 micrometers are used (within the disclosed thicknesses taught by Saito above) and providing larger nucleating diamond particles in the DL layer (substrate) matrix which is depicted as much thicker (see figures Saito), wherein the layer is several hundred micrometers thick, providing a grain size of 40-80 micrometers (for a 10-20 micrometer thick CVD thickness) would provide grains that are exposed on one side of the DL but not the other, and one of ordinary skill would optimize the sizes to within this claimed range providing a well adhered diamond film covering the entire surface of the substrate of Zhu that doesn't peel off and has good adhesion to the substrate (wherein the non diamond substrate of Zhu won't grow diamond). No patentable distinction is seen.

11. It has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

12. Regarding claim 54, it would have been obvious to provide the structure claimed by applicant wherein the two opposing sides having the diamond film taught by Zhu in order to interface as a heat spreader with two opposing surfaces (i.e. A heat source and a heat transfer device) as is common in thermal interface system known in the art.

13. Regarding claims 55 and 56, the particles incorporated into the metal matrix and are part of the surface of the substrate (as in figure 2) is considered to result in deliberately enhanced epitaxy bonding.

14. Regarding claims 78-80, the material of Saito is used as a heat spreader and would meet the claim limitations or in the alternative would be obvious to provide given the diameter of the particles of diamond material and the structural limitations of the material.

## ***Response to Arguments***

15. Applicant's arguments with respect to pending claims have been considered but are moot in view of the new ground(s) of rejection.

16. The previous rejection has been withdrawn due to attorney argument's presented in remarks and the substance of previous interview. It is the examiners position that It would not have been obvious to one having ordinary skill in the art at the time the invention was made to substitute the diamond particle and silicon containing composite material of Ekstrom with the silicon substrate in Deguchi in order to provide a substrate that has a thermal conductance exceeding metals (column 13 line 25-30) and low thermal expansion (column 11 line 35-40), advantageous in heat spreaders. Further, even if substituted it is not clear that applicant's invention would not necessarily be achieved.

17. See newly asserted rejection above.

## *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANIEL MILLER whose telephone number is (571)272-1534. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Keith Hendricks can be reached on (571)272-15401. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Daniel Miller/
Examiner, Art Unit 1794

/JENNIFER MCNEIL/

Supervisory Patent Examiner, Art Unit 1794